State of Illinois
Department of Registration and Education
STATE GEOLOGICAL SURVEY DIVISION
John C. Frye, Chief

GUIDE LEAFLET

GEOLOGICAL SCIENCE FIELD TRIP

Sponsored by
ILLINOIS STATE GEOLOGICAL SURVEY

HARDIN AREA

Calhoun County

Hardin and Brussels Quadrangles

Leaders
George M. Wilson and I. Edgar Odom

Urbana, Illinois
May 2, 1959

GUIDE LEAFLET 1959B HOST: Hardin School

HARDIN GEOLOGICAL SCIENCE FIELD TRIP

ITINERARY

0.0 0.0 Hardin Community High School. Caravan assemble on Childs Avenue heading east.

0.1 0.1 STOP. Turn left (north) on South Park Street.

Note the sharp contrast in the slopes on different parts of the hill seen just ahead. As we travel north along the west side of the Illinois Valley you will see many intervalley spurs such as this one terminated abruptly in steep bluffs aligned parallel with the river valley. These bluffs are the result of processes of valley development, and are independent of the rock structure such as the Hardin Syncline or the Cap-au-Gres Anticline.

The Illinois River is really a relatively young stream little more than 15,000 years old, but part of its valley may be as old as 1,000,000 years. The Illinois Valley from near Depue in Bureau County to its mouth at Grafton in Jersey County was the Ancestral Mississippi River Valley until the Wisconsinan (glacial) Age. Although the Illinoian (third) glacier had advanced from the northeast and blocked the Ancient Mississippi River some distance north of the Hardin area, diverting the Mississippi westward to essentially the same valley it now follows along the western boundary of Illinois, the Mississippi River again switched back to the Illinois Valley after the Illinoian glacier retreated.

According to present knowledge, the uplands of Calhoun County have not been glaciated. The first continental glacier to enter the United States during the Ice Age is called the Nebraskan after the state of Nebraska, where extensive deposits were laid down by this ice sheet. The second glacier, the Kansan, stopped just north and east of the Hardin area as also did the Illinoian (third) glacier. The Wisconsinan (fourth and final) glacier did not come nearer the Hardin area than about 100 miles to the northeast. As the Wisconsinan glacier retreated from the northern part of the United States, lakes ponded behind moraines, and later the Great Lakes discharged large volumes of water down the Illinois River. Some geologists believe that this great volume of water, flowing in a great meltwater river, scoured off the intervalley spurs along the Illinois Valley, while others contend that they were produced by lateral planation by a stream no larger than the present Illinois River. We must all agree that whatever process operated to create these landforms much erosion was required to remove the thick talus that covered the valley slopes like that presently covering the hills on the north, west, and south sides.

0.1 0.2 STOP. Continue ahead.

0.3 0.5 STOP. Enter Highway 100. Continue north. The rocks on the left are Mississippian in age and belong to the Burlington, Sedalia, and Chouteau Formations.

0.6 1.1 The Mississippian Burlington, Sedalia, and Chouteau Formations crop out in the steep bluffs on the left. The Mississippian Hannibal Shale, Louisiana and Glen Park Formations outcrop in the lower portion of the

bluff which is covered by talus. Note again the gentle west and steep east slopes of the hills. The talus along the steep east side has accumulated here in the last 10,000 years.

1.0 2.1 Note the hill just ahead.

0.4 2.5 Two terraces can be seen on the right side of the road.

2.4 4.9 Note the talus fan in the valley on the left side of the road.

1.0 5.9 SLOW. Turn left on gravel road at Michael.

0.3 6.2 SLOW. Turn right.

0.2 6.4 Note the laminated sand and silt on the left side of the road.

1.1 7.5 Note the green Hannibal Shale in the stream bank of the left.

0.2 7.7 Note the deep gullies cut in the loess on the hill ahead.

0.2 7.9 STOP 1. Contact of Hannibal Shale and the Chouteau Limestone.

This outcrop clearly shows a formation break which illustrates why two formations have been described. The Hannibal Shale is greenish to nearly black, and is not fossiliferous.

The overlying Chouteau Limestone in most places lies conformably upon the Hannibal Shale, but since there was a definite change in the kind of sediment deposited, there is justification in calling these rocks by different names. The Chouteau is not especially fossiliferous, and only occasionally will you find many fossils. The limestone in general is rather impure and has many zones of chert. The Hannibal and Chouteau Limestones are formations of the Kinderhookian Group.

0.1 8.0 Note the thin bedded flaggy characteristic of the lower Chouteau Limeston

0.4 8.4 Note the clean scoured surface of the limestone in the stream on the right side of the road.

0.4 8.8 Note the excellent view of the Calhoun County hill country to the southwest. The divide between the Illinois and Mississippi Rivers in this area is very flat. Look at the topographic map provided, and you will see that the summits of the highest hills rise to about the same elevatio This surface is related to the peneplain which we will discuss at Stop 4.

0.8 9.6 Chouteau Limestone outcrop on the left.

0.2 9.8 Hannibal Shale and Chouteau Limestone outcrop on the left. As we go west, the formations rise to the west toward the crest of the Lincoln Anticline which lies to the northwest on the west side of the Mississippi River.

0.5 10.3 Outcrop of the Hannibal Shale, in general unfossiliferous except for a few small plant spores. The coloration is quite distinctive.

0.5 10.8 Note the alluvial gravels on the left, across the stream.

0.7 11.5 SLOW. Rough road and bridge.

0.2 11.7 STOP 2. One of the most interesting Pleistocene outcrops in Calhoun County is at this spot. The section here is as follows:

	Ft.	In.
Wisconsinan Stage		
Loess, light brown, with columnar jointing.	40	
Silt, bedded, laminated, gray, fine		6
Illinoian Stage		
Loess, reddish brown	3	
Gravel with lenses of fluviatile clay and sand, limonite coated, rounded pebbles at the base (reworked "Lafayette"). Chert and quartzite pebbles predominating. In the upper portion the chert is quite angular and may be locally derived.	12	

0.1 11.8 STOP. Enter River Road. Turn left (south).

0.2 12.0 Turn left and then right. Cross bridge. The rocks exposed in the creek are of Devonian age and belong to the Cedar Valley Formation.

STOP 3. The section exposed here is described below:

	Ft.
Mississippian System:	
Glen Park Formation, locally called the Hamburg Oolite, but in this outcrop is not oolitic at all. Here the rock is a silty, cross-bedded, fine-grained dolomite.	10
Louisiana Formation, locally the lowest formation in the Mississippian. The rock is a very fine grained, comparatively thin bedded, sub-lithographic limestone. The overlying formation unconformably overlies the Louisiana, but here the contact is covered.	3-5
Devonian System:	
Cedar Valley Formation, limestone, blue-gray, fossiliferous, moderately thick bedded limestone.	3
Sandstone, light gray to white, medium grained, with secondary grain enlargement, some showing quartz crystal faces. The sandstone is quite friable and in the northern part of the county the sandstone is quite fossiliferous.	2
Limestone, light gray, fossiliferous, dense and hard, medium to thick bedded.	10

			Ft.
0.2	12.2	Note how the loess stands vertically.	
0.4	12.6	Note the outcrop of the Brussels Formation on the left. Note the very interesting small gorge on the right, where the Devonian Cedar Valley Formation overlies the Silurian, Joliet and Kankakee Formations.	22
0.3	12.9	The rounded ironstained gravel is referred to as the "Lafayette" type. Cedar Valley limestone on the right. Turn right.	
0.5	13.4	Road cut in 10-15 feet of loess.	
1.2	14.6	Note the excellent view of the Mississippi River Valley.	
0.6	15.2	Note the outcrop of the lowermost member of the Silurian System, the Noix Oolite. The rock is largely composed of round spherules or oolites. There is some evidence to indicate that the oolites in this instance may have a nucleus of small animal fossils. The oolites are nearly white set in a gray limestone matrix.	
		The section here is as follows:	
		Silurian System: Noix Oolite Formation, limestone, medium gray, fine with varying amounts of oolites, oolites nearly white and varying from 1/2 to 1 millimeter in diameter.	3
		Ordovician System: Maquoketa Shale Formation, shale greenish gray, smooth and clayey	10 plus
1.9	17.1	Loess bluff on right.	
0.5	17.6	Terrace remnant on the right.	
0.4	18.0	Turn left on road to Hardin.	
0.4	18.4	Note the flat terrace on the left, about 15 feet above the road.	
0.4	18.8	Terrace level. Note the weathering in the loess.	
0.5	19.3	STOP 4. The Calhoun Peneplain.	

The uplands of Calhoun County are remarkably flat. Although unperceptible to the unaided eye, this flat surface actually slopes gently southward as far as the Cap-au-Gres Structure. Looking west across the river, you can see an upland surface at about the same height. The elevation of this surface is about 800 feet above sea level.

This upland surface has been called by W. W. Rubey the Calhoun Peneplain. It represents a time in the geologic history of Illinois, probably during the Tertiary Period, when this region stood several

hundred feet nearer sea level and had been worn down to a nearly flat plain very close to base level. The Calhoun Peneplain cuts across the structure of the rocks, that is, it was developed without regard to rock structure. In different places the Calhoun Peneplain truncates the Sedalia, the Burlington, the Keokuk or the Warsaw Formations, yet its flatness is not noticeably affected by differences in the hardness or resistance of these rocks.

The geologic date at which this old erosion surface was finally completed is not definitely known. It is clearly later than the Pennsylvanian McLeansboro Group. It is also distinctly pre-Pleistocene. Various lines of indirect evidence, such as apparent relationship with the Mississippi Embayment and the drainage pattern developed upon the peneplain, and the existence of a thin cover of gravel in which Tertiary fossils have been found, converge to indicate that the surface is probably Tertiary in age.

After the development of the peneplain and before the ice age, a thin blanket of gravel, called the Grover Gravel, was spread over the peneplain. Much of this gravel was removed before the loess of Pleistocene age was deposited, so that only a few isolated patches remain. At the beginning of the Pleistocene Epoch the whole region was moderately uplifted; the rivers began the cutting of their present deep valleys; and the smaller streams that flowed into them began the task of dissecting the upland into a network of ravines and ridges. Today only remnants of the old peneplain surface remain on the tops of the highest hills.

1.6 20.9 Turn right. Follow road to Hardin.

0.2 21.1 Intersection with black top road. Turn left.

0.4 21.5 Note the view of the broad Illinois Valley.

0.2 21.7 Note the abandoned quarry on the left.

0.4 22.1 SLOW. Entering Hardin.

0.8 22.9 STOP. Turn right.

0.1 23.0 Note the strongly inclined bedding of the Burlington Limestone. At this site the rocks are in a tight north limb of the Hardin Syncline. This syncline is one of several similar structures that developed along with several small anticlines in a parallel fashion, whose axes are at about 45 degrees from the main Lincoln Fold or Cap-au-Gres Structure.

Turn left. STOP 5. Lunch.

2.8 25.8 Turn right and then left.

0.2 26.0 Follow road into Lead Hollow.

We quickly pass through the Silurian, Devonian and lower Mississippian rocks, with the Chouteau Formation capping the hill.

1.1 27.1 STOP 6. BE SURE TO SET THE BRAKES ON YOUR CAR! DO NOT CLIMB THE WALLS OF THE CUT, FOR THE MATERIAL IS SOFT AND UNCONSOLIDATED.

The section is here as follows:

	Ft.
Pleistocene loess	5-10
Pebble band at the base, some pebbles rounded, but mostly angular chert, with a brown iron clay matrix	1-3
Deeply weathered ferruginous zone, with a highly irregular zone at the base; the material is a red clay with irregular chert and limestone nodules	3-15
Talus or torrential deposit, ranging from 5 feet thick on the west side of the outcrop to more than 10 feet on the east side.	5-10
Interbedded iron-stained sand and light brown to tan brittle clay	1
Disturbed shale, dark greenish gray and brown, with small geodes, bedding disturbed	3-5
Limestone, blue gray, fine, silty at the base	

0.4 27.5 Devonian Cedar Valley Sandstone beside road on the right and left. Quite fossiliferous.

0.6 28.1 Loess covered hills.

0.6 28.7 Turn left (south) on river road.

0.6 29.3 Excellent view of the Mississippi River and the various chutes.

0.8 30.1 Silt overlain by loess.

0.8 30.9 Kimmswick Limestone outcrop in stream on the left.

0.4 31.3 Note the rapid headward erosion.

2.6 33.9 Enter Batchtown. Continue ahead.

0.2 34.1 Outcrop of Kimmswick Limestone on the right. Note the sinkholes on the left.

0.5 34.6 Note the deeply weathered silt on the left. During Kansan time both the predecessor to the Mississippi River and the Ancient Mississippi River were blocked by ice, and the notch through which we passed at Batchtown served as an outlet for the melting waters. This notch is called a col. The sediment which you see here is a very deeply weathered outwash material.

1.4 36.0 West Point Landing road. By following the road to the landing you will encounter the lower portion of the Kimmswick Limestone, the Decorah Limestone, the Plattin Limestone, the Plattin Dolomite and the St. Peter Sandstone. The rocks rise in the immediate area toward the Cap-au-Gres faulted flexure, or the Lincoln Fold, and this is the north limb of the structure. In this valley are the Kimmswick, Plattin and Decorah Limestones, and at the river's edge the St. Peter Sandstone. The upper limestone (Kimmswick) is crystalline, and light gray to nearly white. As we descend the road for a short distance the Decorah and Plattin Formations are successively exposed.

The Decorah Limestone is identified by the thinner bedding and the abundance of fossils, especially a small brachiopod, Pianodema subequata. The underlying Plattin is massive, rough weathering, dense sub-lithographic limestone with a conchoidal fracture.

0.8 36.8 Turn left at Y.

1.4 38.2 This is the crest of the Lincoln Fold, although no surface indication of this strong structure is shown here.

0.4 38.6 At Beechville cross roads, the road to Dogtown Landing. On the banks of the Mississippi at the Landing you will find the rocks inclined very steeply, indicating the position of the fold and the fault zone.

0.1 38.7 STOP 7. Discussion of the sinkhole topography and the Brussels Plain.

The terrain we see here is called karst topography. Sinkholes develop only in regions that are underlain by thick highly jointed limestone. Rain falls upon the earth, takes on some of the organic acid, enters the joint planes and then attacks the limestone. The waters move along the joint planes, constantly enlarging them. With time the joints widen sufficiently to allow the surficial materials to fall into the widened crevices. Extensively developed, the dissolved joint systems become caverns and caves.

There are four prerequisites for maximum karst development. First, there must be present at or near the surface a soluble rock. Secondly, and one of the most important factors, this soluble rock should be dense, highly jointed, and preferably thin bedded. A highly permeable rock is unfavorable because the rainfall will be absorbed and move through the whole body of the rock rather than concentrate along joint and bedding planes. Permeability as permitted by numerous joints and bedding planes is very favorable if the rock is soluble. The St. Louis Limestone of Mississippian Meramecian age which underlies this upland region is soluble, relatively dense, thin bedded, and highly jointed.

A third condition essential to karst development is that there exist entrenched major valleys below uplands underlain by soluble and well jointed rocks. This condition is essential so that the water that enters and flows along the joint planes has an outlet.

The Brussels Terrace represents an accumulation of stratified silts and sands that fill many of the tributary valleys of the Illinois and Mississippi Rivers in this area. The terrace occurs at about 520 to 540 feet in the Brussels and Hardin area. The town of Brussels about 3 miles southeast is located on this terrace. The sands and silts that compose the terrace were deposited in a Pleistocene lake created in the Illinois and Mississippi River Valleys when a lobe of the Illinoian glacier pushed across and blocked the Mississippi River at St. Louis. The tributary streams are now cut some 60 feet below the terrace surface, making it a very conspicuous feature along the valley sides.

2.6 41.3 T-Road. Turn north. Illinois River Valley on the right.

0.6 41.9 STOP 8. Discussion of the steeply dipping rock on the south limb of the Lincoln Fold. This structure extends from near Grafton, a little north of Pere Marquette Park, across Calhoun County to Cap-au-Gres and on north and west. It is a strongly folded monoclinal structure with some faulting. The total relief on the fold is more than 1000 feet, but individual faults indicate displacements of only a few hundred feet.

By following the stream in Greenbay Hollow you will find rocks ranging stratigraphically from Burlington-Keokuk to Joliet. Thus the St. Louis Formation south of the fold is at the same elevation as the Maquoketa on the north side of the fold.

We are standing on the Deer Plain Terrace, which stands from 40-50 feet above the level of the Illinois River. The terrace sediments vary in composition from silt to sand and gravel. It is thought to be of Wisconsinan age, and subsequent erosion has developed the floodplain cut in this terrace.

3.8 45.7 SLOW. Turn left.

0.1 45.8 SLOW. STOP. Walk north to the Monterey School site. The section here is as follows, from top to bottom:

	Ft.
Mississippian System	
Hannibal Formation, shale, green, weathers rapidly, capping the ridge, with some calcareous concretions. Only the lower portion is here exposed.	12
Devonian System	
Cedar Valley Formation, a gray limestone, thick-bedded. The upper surface here is the pre-Mississippian erosional surface. The surface is iron-stained, and here and there you will find small depressions filled with sand, which is thought to be the Devonian Sylamore Sand. The limestone is here rather thin with thin sand stringers, and is quite fossiliferous. There is a shale break between the Devonian and the Silurian Systems.	2

	Ft.
Silurian System	
Kankakee Formation, dolomitic limestone, cherty in part, with shale breaks, fossiliferous.	15
Edgewood Formation, dolomitic, lower portion covered with talus (accumulated rock detritus).	35
Ordovician System (Maquoketa Formation), a gray-green clayey shale.	100

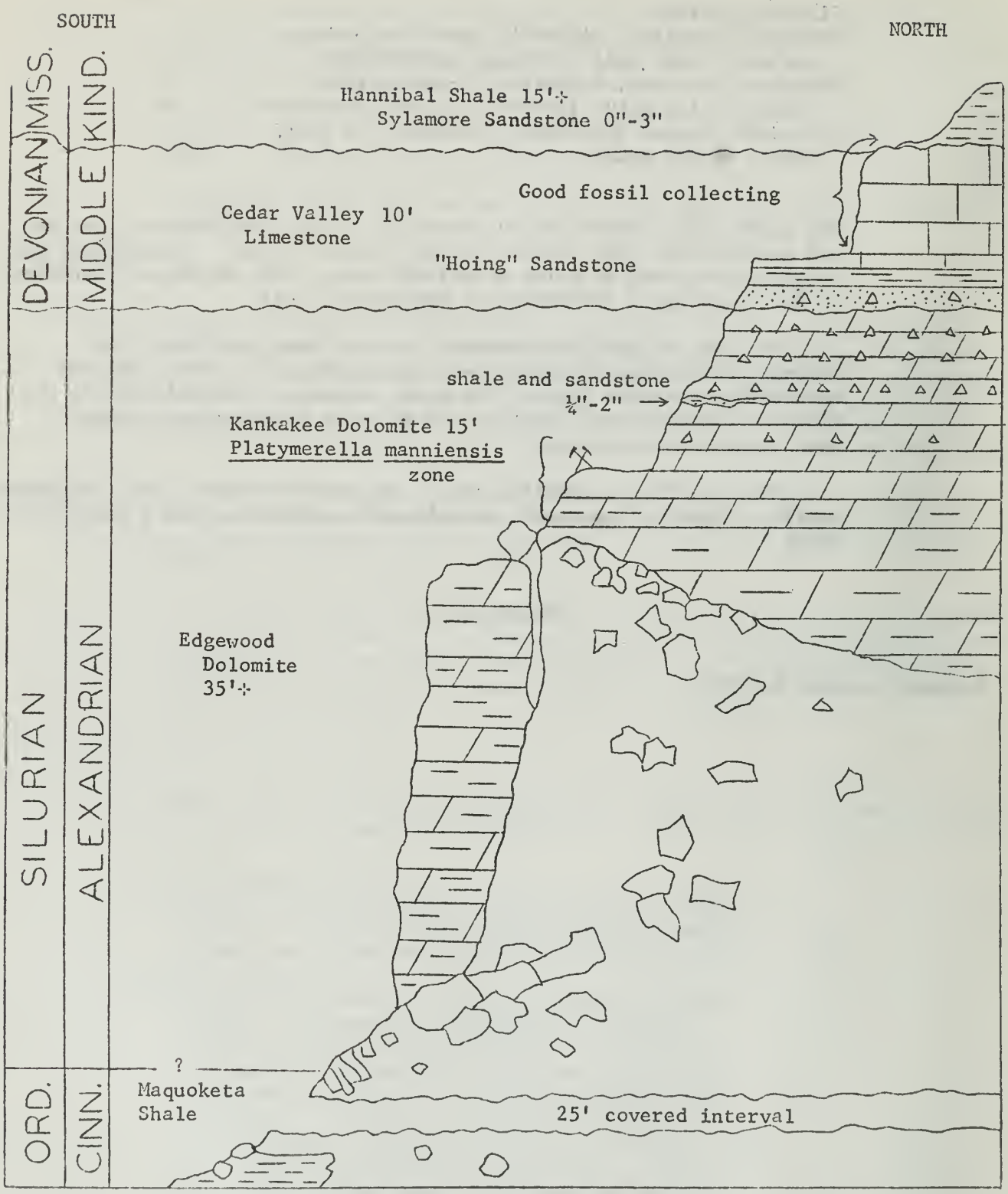
The Cedar Valley Formation in general is quite fossiliferous, and you can occasionally find fossils in the Silurian rocks. Structurally the rocks outcrop here on a low anticlinal nose, with the Meppen Syncline on the south lying just north of the Lincoln Fold.

Be sure to check for exposures in the lower portion of the Edgewood Formation, for there is an unconformable contact with the underlying Maquoketa Shale. The upper surface of the Silurian is also missing since the upper half of the Kankakee Formation was eroded away in pre-Devonian time.

You will find a varied fauna in the Devonian rocks, such as sponges, corals, crinoids, bryozoans, brachiopods, trilobites, and a few fish teeth.

End of Trip

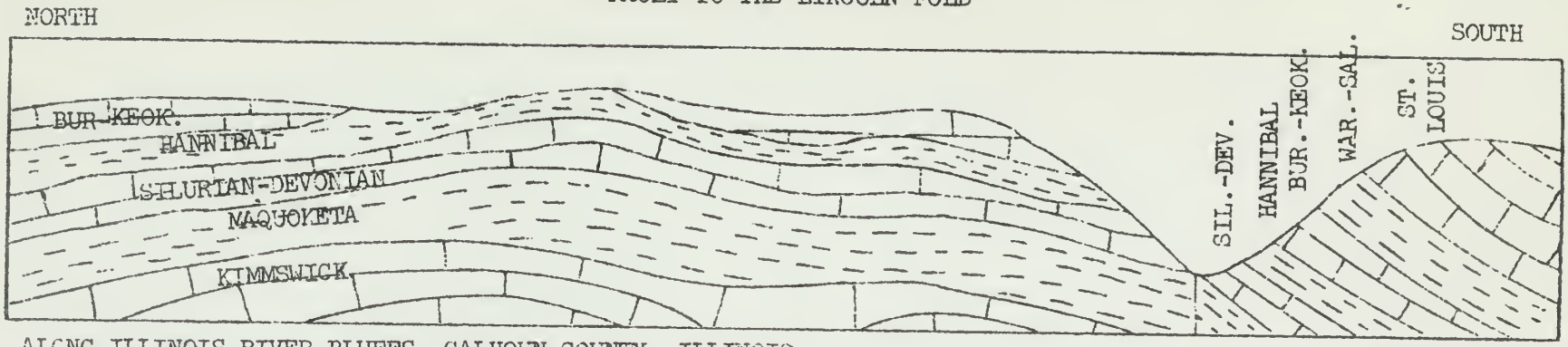
Revised November 3, 1964



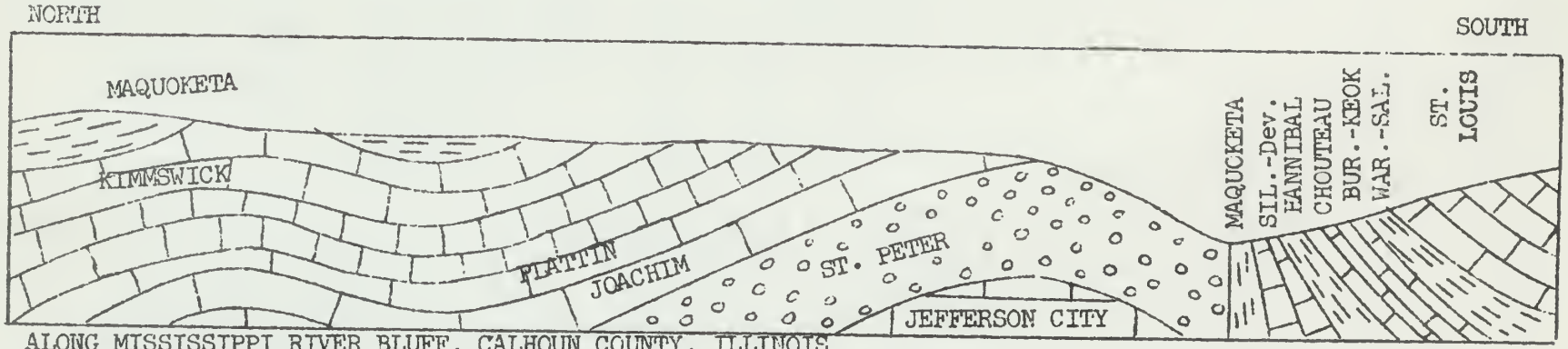
Stop 9. Section at Monterey School

CROSS SECTION SHOWING CORRELATION OF CAP-AU-GRES

FAULT TO THE LINCOLN FOLD



ALONG ILLINOIS RIVER BLUFFS, CALHOUN COUNTY, ILLINOIS.



ALONG MISSISSIPPI RIVER BLUFF, CALHOUN COUNTY, ILLINOIS

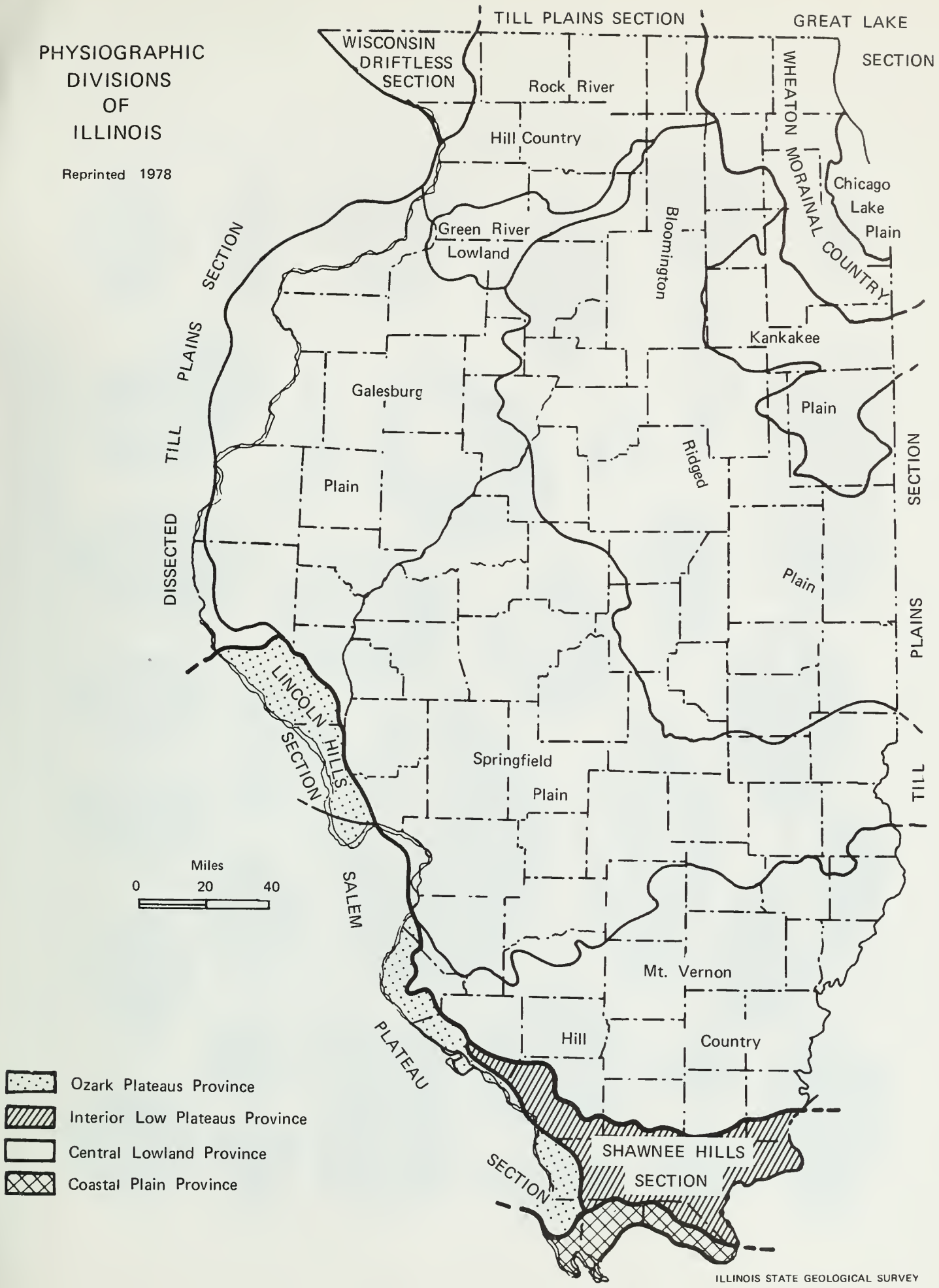
Geologic Column
Southern Calhoun County

ERAS	PERIODS	EPOCHS	FORMATIONS & REMARKS
Cenozoic	Quaternary	Pleistocene	See Pleistocene Time Scale
	Tertiary		Pre-glacial gravels of polished chert.
Mesozoic	Cretaceous		Present in extreme southern Illinois only.
	Jurassic		Not present in Illinois.
	Triassic		Not present in Illinois.
Paleozoic	Permian		Not present in Illinois.
	Pennsylvanian		Scattered outcrops mainly south of Cap-au-Gres Fault.
	Mississippian	Chesterian	Not present in Calhoun Co.
		Early Genevievian	St. Louis Limestone outcrops south of fault.
		Kinderhookian	Chouteau and Burlington Limestones form upper line of bluffs. Hannibal Shale forms terrace in bluffs.
	Devonian	Middle	Cedar Valley Limestone - thin but usually present.
	Silurian	Alexandrian	Dolomite chiefly of early Silurian age forms lower line of bluffs.
	Ordovician	Cincinnatian	Maquoketa Shale outcrops at base of Silurian bluffs.
		Champlainian	Kimmswick Lms. Decorah Lms. Plattin Lms. Joachim Dol. St. Peter Ss. Outcrops chiefly in Batchtown Area.
	Cambrian		No data available.
Proterozoic Archeozoic	Precambrian		No data available.

TIME TABLE OF PLEISTOCENE GLACIATION

STAGE	SUBSTAGE	NATURE OF DEPOSITS	SPECIAL FEATURES
HOLOCENE	Years Before Present	Soil, youthful profile of weathering, lake and river deposits, dunes, peat	
	7,000		
WISCONSINAN (4th glacial)	Valderan	Outwash, lake deposits	Outwash along Mississippi Valley
	11,000		
	Twocreekan	Peat and alluvium	Ice withdrawal, erosion
	12,500		
	Woodfordian	Drift, loess, dunes, lake deposits	Glaciation; building of many moraines as far south as Shelbyville; extensive valley trains, outwash plains, and lakes
	22,000		
	Farmdalian	Soil, silt, and peat	Ice withdrawal, weathering, and erosion
	28,000		
	Altonian	Drift, loess	Glaciation in northern Illinois, valley trains along major rivers
	75,000		
SANGAMONIAN (3rd interglacial)		Soil, mature profile of weathering	
	175,000		
ILLINOIAN (3rd glacial)	Jubileean	Drift, loess	Glaciers from northeast at maximum reached Mississippi River and nearly to southern tip of Illinois
	Monican	Drift, loess	
	Liman	Drift, loess	
	300,000		
YARMOUTHIAN (2nd interglacial)		Soil, mature profile of weathering	
	600,000		
KANSAN (2nd glacial)		Drift, loess	Glaciers from northeast and northwest covered much of state
	700,000		
AFTONIAN (1st interglacial)		Soil, mature profile of weathering	
	900,000		
NEBRASKAN (1st glacial)		Drift	Glaciers from northwest invaded western Illinois
	1,200,000 or more		

(Illinois State Geological Survey, 1973)


PHYSIOGRAPHIC DIVISIONS OF ILLINOIS
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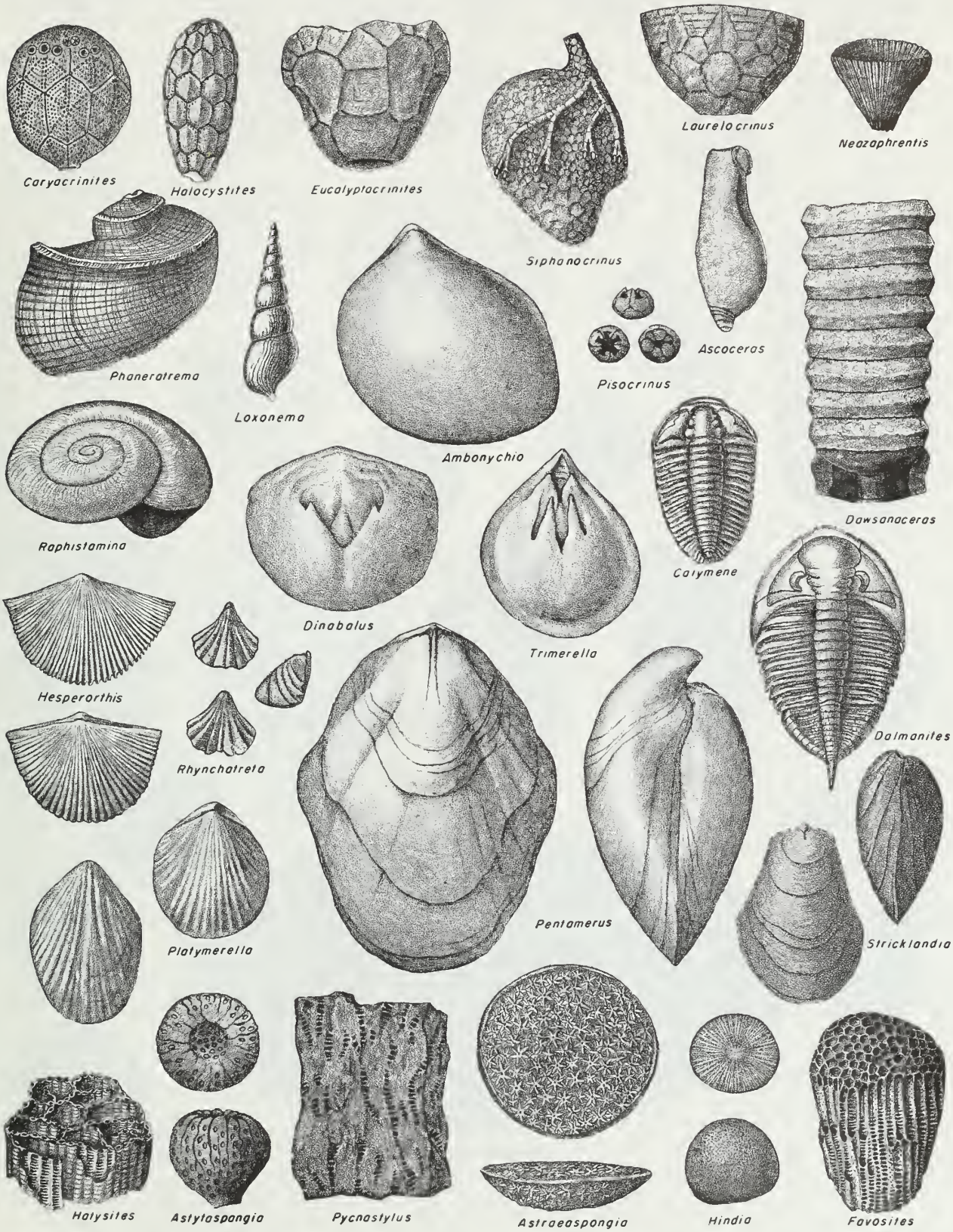
TILL PLAINS SECTION
GREAT LAKE SECTION
WISCONSIN DRIFTLESS SECTION
Rock River Hill Country
WHEATON MORAINAL COUNTRY
Chicago Lake Plain
Green River Lowland
Bloomington Ridged Plain
Kankakee Plain
Galesburg Plain
DISSECTED TILL PLAINS SECTION
TILL PLAINS SECTION
Springfield Plain
LINCOLN HILLS SECTION
Miles
0 20 40
SALEM PLATEAU
Mt. Vernon Hill Country
SHAWNEE HILLS SECTION
Ozark Plateaus Province
Interior Low Plateaus Province
Central Lowland Province
Coastal Plain Province
ILLINOIS STATE GEOLOGICAL SURVEY

REPRESENTATIVE SILURIAN FOSSILS FROM NORTHWESTERN ILLINOIS



ORDOVICIAN FOSSILS